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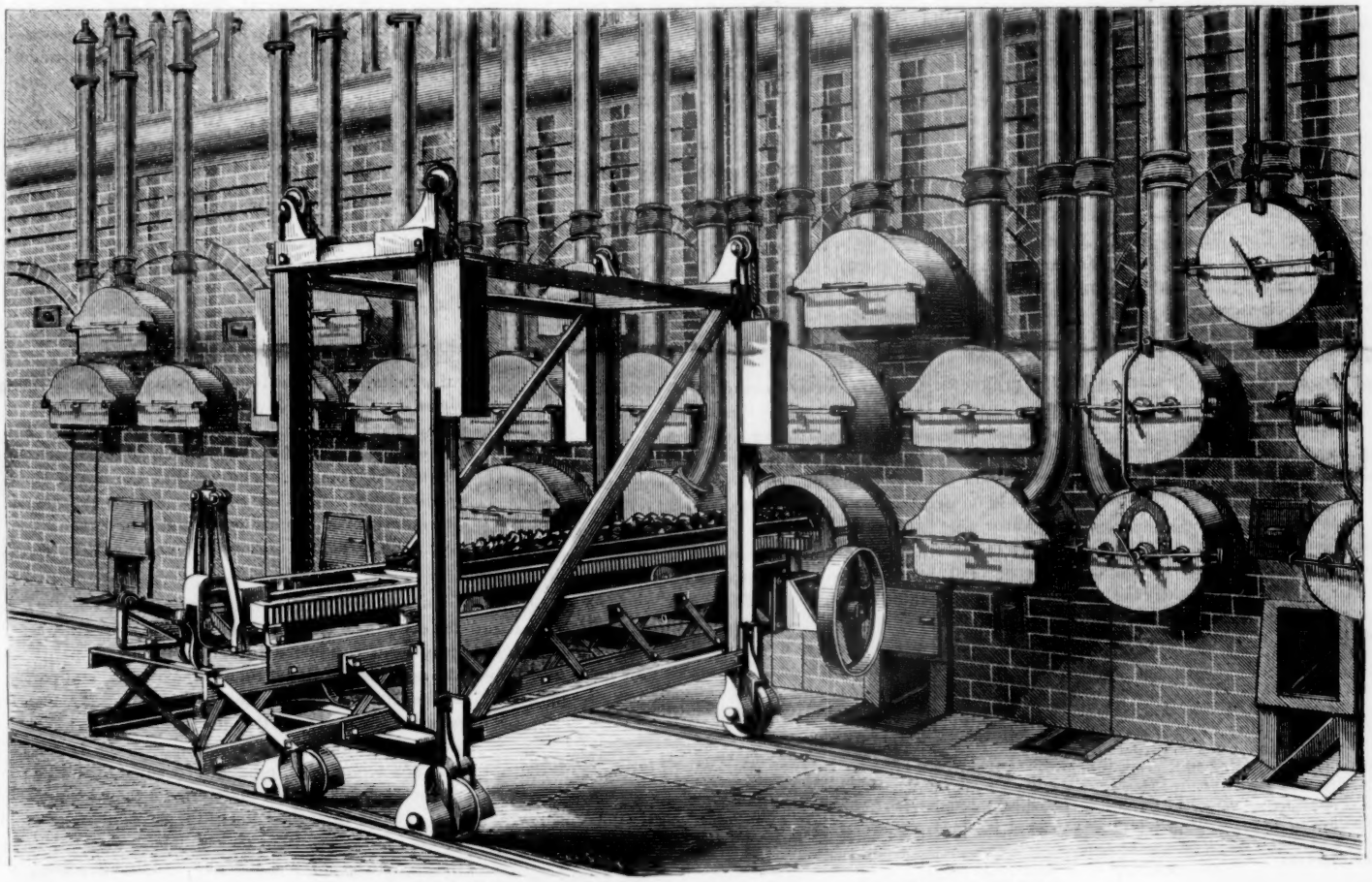

Stoking by Machinery—ALONZO F. HAVENS'S INVENTION—See Editorial page (102).

Velocity of Light.

Recently, M. Fzeau has communicated to *Les Mondes* the results of a series of very eloborate experiments made with a view to the most accurate determination of the velocity of light. The distance between the two stations of observation as found by triangulation, was 33,829.1 feet (about six miles), with a probable error of 0.001. The source of the ray was a jet of oxyhydric gas. Six hundred and fifty satisfactory observations were made, the mean of which gave 185,368 miles per second as the required velocity. The experiments of M. Foucalt to determine this same velocity give us a result of 185,177 miles.

The formerly accepted determination of the velocity of light was that of Olaf Roemer, a Danish astronomer, who deduced it from observations on Jupiter's satellites. The earth's orbit being concentric with that of Jupiter, and interior to it, the distance of these bodies is continually varying, the variation extending from the sun to the difference of the radii of the two orbits, making the excess of the greatest over the least distance equal to the diameter of the earth's orbit. A comparison of the eclipses of Jupiter's satellites during many successive years, showed that those which took place about opposition were observed earlier, and those about conjunction later than an average or mean time of occurrence. Connecting the observed acceleration in the one case, and retardation in the other, with the variation of Jupiter's distance distance below and above its average value, the difference was fully and accurately accounted for by allowing 17m, 26s. 7 for light to traverse the diameter of the earth's orbit. From these data Roemer found the velocity of light to be about 192,000 miles per second.

It seems at first sight as if the recent and very accurate determination of M. Fileau had demonstrated a defect in the earlier method, indicating, perhaps, some cause, connected with the acceleration and retardation of the apparent occultations of Jupiter's satellites, other than the time required for light to traverse the earth's orbit. But Capt. C. W. Raymond, U. S. Engineers, at present Assistant Professor of Physics at West Point, calls attention to the curious fact that by substituting in Roemer's calculation a more modern and more accurate value of the diameter of the earth's orbit, the resultant measure of the velocity of light becomes 185,344 miles per second as the velocity. This is one of the questions which will be affected by the thorough observations to be made by trained astronomers of all nations, of the next transit of Venus. The diameter of the earth's orbit, which may be called our astronomical unit of distance, will be probably finally determined by those observations. —*Engineering and Mining Journal.*

Chemical Repertory.

No. 99.—September 16, 1873.

EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

850. News from Illinois, via England.—Springfield, Ill., has a model rail mill, owned and operated by a stock company. This company has lately put up a gas-producing house, containing 16 gas-producers, supplying four Siemens regenerating gas heating and two puddling furnaces, with gas made almost entirely from slack (coal), which is obtained from a large pit close to the mill. The coke from these furnaces is used with about 50 per cent. of new fuel, for the production of steam, used in running the machinery, and for an increased supply of steam. They are building an additional battery of boilers, which, when finished, will give them twenty boilers. Besides the Siemens furnaces mentioned, they have one new heating, and six ordinary puddling furnaces. The capacity of the gas heating furnaces is twenty-four tons each, daily. The average waste being only about five per cent. in heating. Trestle work is being built around two sides of the mill, over which the coal used in the works will be brought directly from the mine and deposited where needed. The engine in the rail mill was built by Totten & Co., of Pittsburgh, being vertical, with forty-inch cylinder and thirty-six inch stroke, driving a fly-wheel of sixty-two tons weight, and making 70 revolutions to the minute. The puddling mill engine is also vertical, thirty-two inch cylinder, thirty inch stroke, driving a forty-ton fly-wheel forty-nine revolutions per minute. The rail train is two-inch, muck train eighteen-inch. Milwaukee and Iron mountain iron is used with old rails.—*Iron.*

851. The Hot Blast.—Prof. Akerman, of the Polytechnic Institution of Stockholm, and Prof. Turner, of the mining school at Leaben, in Austria, have published their views concerning the influence of the hot blast in the furnace. Akerman contends that the great increase in temperature, and the consequent economy of fuel, is chiefly attributable to the circumstance that the heat which is carried by the blast into the furnace, as compared to that created by the combustion of the fuel, is introduced therein without increasing the volume of the gases, as a greater bulk of expanded gas, escaping at the furnace top, will naturally carry more heat with it. Seeing, however, that a hot blast of only 350° to 450°, Fah., will cause an economy of 25 per cent. of fuel over a cold blast, Turner asserts that, besides the actual quantity of heat which the blast carries with it, its favorable influence must be sought in the fact that it facilitates a rapid and complete combustion of the fuel, forming carbonic acid only, which again is not so readily reduced to carbonic oxide, as Akerman and Bell seem to take for granted. While Akerman is of the opinion that, for producing white forge pig, the temperature of the blast should not be raised above 500° Fahrenheit, it is claimed that in Styria white and mottled pig irons are constantly produced with hot blast of over 900° Fahrenheit—when the burden is only fluxed with somewhat more lime, the pressure of the blast diminishes, and the furnace widens to some extent.—*Am. Exch. and Review.*

852. The Largest Steam Engine in the World.—Pittsburgh claims to have in progress of construction a pair of engines which will be the most powerful in the world. Reducing the capacity of some of the largest pumping engines to a uniform lift of one foot in twenty-four hours, it is found that the one at the Lehigh zinc mines will lift 3,446,000,000 gallons; the pair at the Chicago water works, 4,500,000,000 gallons; the pair at Haarlem, Holland, 10,000,000,000 gallons; while the new Pittsburgh engines will lift 14,240,000,000 gallons. The pair will weigh 1,500 tuns, and will cost $423,550. The following dimensions will serve to give some idea of the magnitude:

Cranks, nine tuns; shaft, twenty-four tuns; four sections of the two valve chambers, one hundred and twenty tuns; fly wheel, seventy tuns. The four plungers will weigh upwards of four hundred tuns. Cylinder, sixty-four inches diameter; stroke, 14 feet. Plungers forty inches diameter; 11 feet stroke. This ponderous piece of machinery will be used to raise water into Highland avenue reservoir in Pittsburgh, a height of 356 feet. It is estimated it will raise 70,000,000 pounds of water for each hundred pounds of coal consumed, the cost being at the rate of one cent for every 3,070 gallons.—*Sci. Am.*

853. A Boulder in Coal.—The last received number of the *London Geological Magazine*, one of the most instructive and interesting publications of the scientific press, commences with Mr. Banney's account of a boulder of quartzite found enveloped in the coal of the 13th bed of the Cannock and Rugeley Colliery, South Staffordshire, 540 feet beneath the surface. It is 19 inches square by 4 inches thick, and weighs nearly 14 lbs. It was probably floated in the roots of a tree into the marsh vegetation which formed the coal bed.—*U. S. R. R. and Min. Reg.*

854. Gas from Petroleum-Tar.—A man tells the *Scientific American* that he "makes the gas to light our building in iron retorts, from what is known in the trade as 'residuum.' It is the black tar-like oil from refined petroleum; it makes good gas, but is quite expensive on account of the high heat required, and the amount of fuel (coke) it requires to get up the heat. Is there anything we could use that would not require so great a heat and that would be equally as free from danger in using? The high heat soon burns out the retorts and new ones are quite expensive." Wonder if he has heard that crude petroleum is selling at $1.50 about half what its residuum costs.—*Nat. Oil Jour.*

855. Washoe Coal.—Speaking of Washoe coal, the *Territorial Enterprise* says:

Some parties in this city, who are mining for coal in El Dorado Canyon, Lyon county, eight or ten miles beyond Dayton, are meeting with very flattering success. At no great depth, they have found a very promising vein of coal, several feet thick, which burns well and freely, and which contains no sulphur. The coal appears to be lignite, and in appearance does not differ materially from other deposits of that mineral that have at various times been opened in that section of the State. About two tons of the coal have been brought to this city. We yesterday saw some of it tested in a small coal stove, and it seemed to burn about as well as any other coal could have done. A fire made of it at nine o'clock in the morning was still burning when we saw it at half-past one P. M. It leaves a considerable quantity of ashes, which appears to be due to a kind of sediment composed of calcareous matter mixed with the coal at the time of its formation. At a greater depth on the vein this will doubtless disappear. We hope the mine may prove to be all that its owners believe it promises to become.—*Min. and Sci. Press.*

856. Nitrate of Amyle.—This is one of the new numerous products of coal-tar, and a few drops on the handkerchief will, when inhaled, prevent epileptic fits, and relieve asthma.—*Manf. and Builder.*

857. English Gas Patent.—C. W. Harrison, High Holborn, Middlesex. Improvements in the treatment and use of air for the manufacture of gas for lighting and heating purposes, and in the apparatus employed therein.—A method of oxygenising air by passing it under pressure or otherwise through water or any other suitable liquid that will absorb a larger proportion of the oxygen of the air than of the nitrogen. The air thus oxygenised is recovered from the water by a pump or other suitable means, and stored for use in a holder, whence it is conveyed by pipes to where required for use, and is then passed through a suitable hydrocarbon and thus converted into inflammable gas or vapor adapted to heating and lighting purposes.

Iron refers to this patent in the following terms:

Mr. C. W. Harrison has a kind of supplement to his invention of Air-gas for lighting and heating purposes, wherein there seems to be some "solution of continuity" between the ends and means proposed. The object is to oxygenise air previously to its being passed through a suitable hydrocarbon, for conversion into inflammable gas or vapor; the presumption being that the excess of oxygen will increase the heating and illuminating power. The process, however, consists in passing atmospheric air, under pressure or otherwise, through water, or any other suitable liquid, "that will absorb a larger proportion of the oxygen of the air than of the nitrogen," which would seem to have exactly the opposite effect, namely, of de-oxygenising it.

858. On the Condensation Products of Illuminating Gas.—R. Gasch.—The lowest temperature possible for destructive distillation is shown theoretically and practically to be the best for the preservation of a maximum of illuminating vapors in the gas. The temperature of the condensers, scrubbers, and purifiers has much effect on the quality of the gas obtained. If the temperature of the condenser is too high, or the proportion of other oils to naphthalene is too small, or the temperature of the pipes through which the gas passes is made too low, the danger of choking the pipes by naphthalene is incurred. Such stoppages are more apt to occur in autumn and spring than at other seasons, the differences of temperature between day and night or between two consecutive days being then greater.—*Journal fuer Gasbeleuchtung.*

859. Determination of Ammonia.—M. A. Houzeau.—The gas before entering the meter is passed through 5 c. c. of sulphuric acid containig 0·30625 gr. of ammonia. This acid liquor is colored by a few drops of litmus, and gas being passed through until it becomes blue, the proportion of ammonia is readily determinable by the quantity of gas treated as read by the meter.—*Chem. News.*

860. Sal Ammoniac in the Hydraulic Main.—R. Gasch.—The presence of the chlorine was a source of wonder, and it was found to come from the Zwickau coal. The water is sometimes so completely saturated that the salt crystallizes out on cooling. The tar of the main was found to contain 25 to 50 per cent of ammonic chloride. The result of the use of these coals was to cause more carbonic acid in the gas, as the chlorine compounds prevented the formation of ammonic carbonate.—*Journal fuer Gas-beleuchtung.*

861. Safety Lamps.—Some valuable researches on the conditions under which safety lamps are truly safe, have been conducted by M. R. Galloway, partly at the new laboratories at South Kensington, and partly at the Meteorological office, in London. Mr. Galloway has already found that if a Davy lamp be burning tranquilly in an explosive atmosphere, the transmission of a sound wave, produced by slight explosion of gunpowder, is sufficient to determine the communication of flame from the lamp to the surrounding atmosphere. Hitherto, it has generally been assumed that the occurrence of a colliery explosion, after firing a shot, is due to actual communication of flame from the gunpowder to the fire-damp; but Mr. Galloway's experiments show that it is much more likely that the explosion is determined by the noise of the shot being promulgated through the galleries of the mine to the safety lamps. An admirable experiment to illustrate this point, was exhibited by Dr. Spottiswoode, at a recent lecture at the Royal Institution. A lighted Davy lamp was surrounded by streams of coal gas, issuing from a number of jets around the base of the lamp. One extremity of a long tin tube, open at both ends, was placed in connection with the lamp, while a pistol was fired at the other end, a caoutchouc diaphragm being interposed in the tube to prevent the transmission of a direct current or air. The sound wave, generated by the report, traveled along the tube, and as soon as it reached the flame, caused ignition of the surrounding atmosphere—the lamp being immediately enveloped in flames.—*American Artisan.*

British Association of Gas Managers.

TUESDAY, JUNE 10.

Mr. J. Eldridge (Richmond) read a paper "On the Application of 'Coffey's Still' for the Extraction of Ammonia."

At most of our annual meetings the attention of members has been called to the various modes of washing, scrubbing, etc., with a view of extracting ammonia and other impurities from the gas before it reaches the purifiers.

When sulphate of ammonia is made in large quantities a vessel called a "column," or "Coffey's still," is used, in which ascending steam is made to come in contact with descending streams of ammoniacal liquor, and the ammonia thus becoming vaporized passes from the still through a pipe to the saturator.

A similar vessel is sometimes, though not frequently, used on gas works. I have one in use on our works, and as it has proved very effective I now proposed to give a brief description of its construction and working for the benefit of those who may not have seen one. It can be made of any dimensions. A drawing was shown of one 24 feet high, 4 feet wide, and 2 feet thick, cast in eight 3-feet lengths, with flanges, and put together with bolts, nuts, and lead pipe in the usual way.

From below the outlet to just above the inlet are a series of shelves 3 feet 4 inches long, and about 8 inches apart, thus leaving an opening of 8 inches by 24 inches at each end. These shelves rests on fillets cast on the side of the still, the open end of the one being over the end of the other, which is not open, and in some measure resembles a series of steps. On the open end of the shelf is a ledge half an inch high, so that each one has always water over it to that depth. The water is pumped in at the top of the still through a 2-inch pipe, when it falls on the first shelf, runs over the ledge at the end to the next one, and so on down through the whole till it reaches the bottom, thus forming a continuous stream of two feet wide and hal an inch thick, as well as a series of small waterfalls. The water runs out at the bottom into a tank, where the outlet pipe is, of course, sealed in the usual way.

The pipe through which the water is supplied at the top may be of any size, or can be regulated by a valve so as to give whatever quantity may be thought necessary, according to the make of gas. The gas entering at the bottom of the still passes backwards and forwards in the course of its ascent, and comes in contact with all the descending waterfalls, and, of course, over the water on each shelf.

On the works of which I am manager we have a good sized coke scrubber, through which we pump the ordinary ammoniacal liquor over and over again at the rate of about 1000 gallons per hour, till it is about 16° of strength. The gas then passes through the still, in which water is used at the rate of 1000 gallons per hour, till it is about 8° of strength, and it is then used for making sulphate.

In the ordinary coke scrubber the tar and coke frequently become nearly a solid mass, causing a great deal of pressure. Mr. Anderson, when speaking on this subject at Nottingham, in 1867, said, "he had seen, at the opening of scrubbers, certain sinuous channels through the coke, which channels were glutinized with tar."

In the still the least obstruction is impossible, and the pressure is therefore *nil*—a feature which all managers will readily appreciate. I am aware that scrubbers charged with boulders, brickbats, broken bottles, drain-tiles, etc., or fitted with boards, are less liable to become obstructed by tar than those containing coke; still the remarks about pressure apply more or less to the whole.

Another advantage of the still is that it requires no distributing apparatus: the water is simply pumped in through the pipe on the top, and rushes from shelf to shelf till it reaches the bottom.

We all know that in the ordinary coke scrubbers there are frequent difficulties in the distribution of the liquid. The "Barker mill" will sometimes get out of gear; the revolving brushwood—excellent as the plan is—sometimes gets clogged with tar; the simple perforated pipe becomes partly stopped, so that it is not an uncommon thing for the gas to be passing through what may in some measure be called a dry scrubber. This is impossible with the still. Another advantage is that the still is very simple and economical in its construction.

I wish to say, in conclusion, that these few remarks on rather an important subject are respectfully offered to those who, like myself, are managers of comparatively small works. Speaking from experience, I have always found in the use of the still that the whole of the ammonia has been taken out of the gas, and of course utilized, and the expense of purifying materially reduced.

Mr Eldridge said that Mr. Sugg firsf called his attention to the Coffey still, and strongly advised its use. He might further state that Mr. Barclay, of Tottenham, had used the still with great success for a number of years.

Mr. Syms (Rochester) suggested that the value of the process would be much more intelligible to the meeting if Mr. Eldridge would give the proportion of water per 1000 cubic feet of gas instead of the quantity passed per hour.

Mr. Warner said the reader had suggested doubts as to the stoppage of washers, but for his own part he could not understand why boards placed perpendicularly, or only at a slight inclination, should be more likely to stop up than horizontal bars. In the paper read before the association upon scrubbers, two years ago, it was clearly shown that with boards such as Mr. Livesey and he (Mr. Warner) employed there was no tendency to stoppages.

Mr. Watson (Sydenham) asked for information on two points—first, whether Mr. Eldridge relied entirely on this scrubber—for after all it was a scrubber—for the removal of ammonia; and secondly what amount of ammonia per 1000 feet was left in the gas after passing through it.

Mr. George Anderson (London) said he had been in hopes that the paper just read would have gone into some statistics as to the manufacture of sulphate of ammonia, because the fact of that article being made by Coffey's still was an old affair. All the members of the association who were present at the meeting held in London some seven years ago, and paid a visit to certain chemical works there, had the opportunity of seeing the manufacture of sulphate of ammonia upon a large scale entirely by the use of the Coffey still. Perhaps Mr. Eldridge in his reply would be able to furnish the meeting with some facts showing the economy of the process he adopted, the amount of acid necessary, the quantity of coals used per ton, and each other practical statistics as would enable them to judge of the value of the process as compared with other modes of manufacture. If he (Mr. Anderson) understood Mr. Eldridge aright that gentleman said he used a second still; if so, that was not a good mode of extracting ammonia. Mr. Eldridge stated that while the gas was passing upwards he had a stream of water passing at the rate of 1000 gallons per hour down the various shelves of this apparatus, and that in this way such a neighborly action went on between the gas and the water that the ammonia was extracted. Now he (Mr. Anderson) must say he was afraid that there being a space over the water on each shelf and between it and the next there would not be so good a contact as if the gas had to pass through and alongside pieces of coke, saturated with water, of various sizes, large at bottom and small at top of the scrubber. Unless means were taken to cause the gas in very fine particles or divisions to pass through the scrubber, he did not believe the ammonia would be extracted profitably from the gas. There was also another remark to be made. If the gas were allowed to go into the scrubber before the tar and all the liquid products were thoroughly extracted from it, he should not call that good engineering. In order to do that as far as possible in the works with which he was connected he used a water washer. In that washer he put the washings of the scrubber, as also the ordinary ammoniacal liquor from the works. By passing the gas through the ammoniacal liquor he got rid of the tar; and he might here state that he had a scrubber in use at the present time which had been in action since 1864 or 1865, and had never been opened until last week. It was then opened by his direction, not because it had ceased to act, but because at this season of the year it was well to inspect every kind of apparatus on the works. Certainly this scrubber had been in action during the whole of the time he had named, and there had never been anything wrong with it. He believed the cause of this was that he got rid of the tar before the gas went into the scrubber. In that scrubber he did not use ammoniacal liquor as Mr. Eldridge did, because he did not believe that by so doing he could entirely, though perhaps he might partially purify his gas from ammonia. If they passed gas through ammoniacal liquor of 6 oz. strength, for instance, and then passed it through water or ammoniacal liquor of 12 oz strength, they would have their gas pure. To purify gas from ammonia they must either use some acid or allow the gas in passing last through the scrubber to pass through pure water. If they pumped ammoniacal liquor over and over again up to 16° strength, what was the result? Each time as the liquor became stronger and stronger the less affinity had it for extracting ammonia from the gas. Now he contended that all this pumping over and over again was a mistake. They had no business to pump at all, and if their scrubbers were properly constructed they had no necessity for it. They should put through their scrubbers as much water as was equal to the ordinary quantity of ammoniacal liquor. He was in the habit of putting 10 or 12 gallons of pure water through his scrubbers from the top, and he thus obtained 20 to 22 gallons of ammoniacal liquor per ton of 12 oz. strength throughout, and he had a practically pure gas. He believed that if the scrubbers were made high enough and the water was put through slowly, there would never be any necessity for pumping. Then in addition to the scrubber there should be a previous washing to prepare the gas for the scrubber. Thus operating, they could, by methods long in practice and well known, perform all that was possible of attainment by any new and fanciful processes.

Mr. Eldridge in reply said, Mr. Syms asked the quantity of water per 1000 cubic feet he employed. At the present time in his works he used 1000 gallons per hour, passing about 7000 cubic feet of gas during the same period. Mr. Warner did not agree with his comparison of this still with scrubbers in which boards were used. But he did not mean to say that in all cases where boards were used there must necessarily be stoppages, but that there was a tendency in almost all of them to that result, whereas in the Coffey still it was perfectly impossible. Mr. Watson asked whether he depended upon this still alone for the extraction of his ammonia. He had already stated that he first used a scrubber charged with coke, which took out a considerable portion of the ammonia, so much so that by pumping the ordinary liquor over and over again, he got it up to 140° strength. Nevertheless a great deal of ammonia did pass to the still, otherwise he should get the water pure. He found, however, in the winter that after using the still for a day or two the water came up to 7° or 8° of strength. Mr. Anderson and Mr. Watson both asked for statistics. All he (Mr. Eldridge) could say was that he had not gone into them at all, and did not read the paper with any reference to the manufacture of sulphate of ammonia. He therefore could not answer the question as to the amount of acid necessary, nor the quantity of coals used in the manufacture per ton of sulphate; his object had simply been to show the utility of the still in the manufacture of gas. He might state that only a short time ago he had occasion to stop the still for about twelve hours, and his purifiers were off twelve hours sooner, which he thought was conclusive proof with regard to the value of the apparatus in purification. Since he had had the still in operation the produce in sulphate of ammonia had been very much greater. The question was asked whether the still did really take out the ammonia. The fact he had stated, that by using clean water he obtained, after a while, 7 oz. or 8 oz. liquor, was a proof that it did take it out.

The President said the association was much indebted to Mr. Eldridge. The first application of what might be called an approximation to the Coffey still, was a condenser erected by the Dover Gas Company thirty years ago. It was in the form of a flat worm. The hot gas was admitted at the top and the coal gas passed out at the bottom, so that the condensible matter met the gas in the opposite way, and it was the most effective condenser he knew of. The same plan was adopted by Mr. Barclay, at Tottenham, where the main was put up as a boundary to the works. It was laid in a horizontal position, with a slight fall. The gas went in at one end, the condensible matter met it in the opposite direction, and it became a most effective scrubber.

Mr. Warner asked whether the condenser at Dover was in use before one of the same kind was used at Birmingham.

The President said he could only state that it must have been about thirty years ago.

Mr. Garnet (Hyde) said there was one at Portsea thirty-five years ago.

The President remarked that it was thus we sometimes thought we had something new, which, upon investigation, was found to be very old.

Tennessee Oil Lands.—That Tennessee possessed oil lands of apparently great value became known soon after the close of the war: but after a few wells had been sunk, it was found that so few means of transportation existed as to render even flowing wells almost useless, and work was abandoned. The valuable discoveries are not to be suffered to remain permanently unemployed, for a new railway, designed to afford an outlet for the product of the wells, is rapidly building through Overton county. A new oil-hunting mania may agitate the country within the year, when once discoverers can bring their oil to Eastern markets.—*Coal and Iron Record.*

Prof. Silliman's Report on Water-Supply of Norwich, Conn.

[To our regret, the close calculations necessary to us, nowadays, as to space preclude anything more than a very condensed abstract of this careful and valuable investigation.—Ed.]

To the Board of Water Commissioners,

City of Norwich Water Works.

Gentlemen: I have the honor to report to you the result of my examinations of your reservoir, and of the samples of waters collected by me on the seventh inst.

The reservoir is an artificial lake, formed by a dam built across the ravine between two hills of crystalline rocks of the granitic family, situated about 2½ miles northwest of your city, and draining both into the Yantic and the Shetucket rivers.

The margin of the reservoir is quite clean, and free from any causes of impurity. The water-shed discharging into this reservoir is largely in grass or upland mowing ground, with some woods and orchards, with but few houses or farm buildings upon the slopes, consequently no sewage, or water contaminated with animal matter, finds its way into your reservoir.

An excellent dry wall, more than 2 miles in circuit, encloses the reservoir and shuts off, to a great extent, the shallow margins which often form an objectionable feature in both artificial and natural lakes.

It appears from the statements of your report that the bottom of this reservoir has been prepared for flowage by removing nearly twenty thousand stumps of trees, and that the entire bed of the lake was cleaned over, and all soil containing grasses or roots entirely removed. The thoroughness of this work may be judged by the fact that over three hundred thousand cart-loads of materials were excavated and removed. I may remark that this is an unusual degree of care and thoroughness in the preparation of ground for flowage—many such works, within my own knowledge, having been completed without any such needful care. The only additional precaution which could have been taken would have been the shingling of the scarfed surface with clean gravel and sand.

The average depth of this lake is stated at over 16 feet. At the lower end, near the well house, it is said to be over 30 feet. At the time of my visit the water was drawn down over 5 feet below high water point, but it was then rising, and I found it over 22 feet in depth at the point where my sample, No 1 was drawn, which was not quite the lowest, although the most convenient point at which I could obtain samples in depth. It is calculated that each half-inch of depth of the lake is equal to one million of gallons, and consequently the lake, at the time of my visit, was about one hundred and twenty millions of gallons below its maximum capacity, which is stated at about three hundred and sixty millions of United States standard gallons. The present consumption of your city is stated under one million of gallons daily.

OF THE WATERS.

Several citizens informed me that the water had lately been offensive both to taste and smell.

Some remarked upon the odor, as well as taste, being offensive. The most general statement was that the water had a "*fish-like*" odor or flavor, while others simply compared it to *bog-water*, or *pond-water*.

On the 7th of January I made visits to several points where all agreed it had been the most offensive.

The color was slightly yellowish brown, and I fancied in one or two places that the flavor was a little marked by the vegetable extractive matter, which was the cause of the color. I was assured in all the places which I visited, that some two weeks before there was no difficulty in finding the qualities which all, equally with myself, agreed were now sensibly absent.

Five samples of your water were collected, as follows:

1. One from the surface of the lake, at a hole cut in the ice.

2. One from the depth of 12 feet below the surface of the ice.

3. One from near the bottom of the lake, at the depth of 22 feet.

4. One from the waste-wipe—which draws off the water from the very lowest level of the bottom.

5. One from the tap in the house of Mr. S. G. Richmond.

They were compared for color with pure distilled water, in a similar vessel. All were some shades of "off-color," the tint being slightly yellowish brown, the usual color of pond water.

At the temperature of the room, all had the taste of soft water.

It is a fact well-known to wine-tasters that if wine is largely diluted with water it develops every disagreeable flavor which the water may contain, even if this is not sensible when the water alone was tasted. Sherry wine is the best wine for this test. By using this test a slightly disagreeable flavor was brought out in No. 4, while the other samples were free from any disagreeable flavor.

Smell.—There was no odor sensible to myself, or several other persons who tried this test at 60° F., in the same glass vessels used for the comparison of color; these samples being gently warmed to 100° F., also with a negative result. At the Wauregan house, the landlord mentioned that sometimes they noticed a disagreeable odor when the water was warmed. He was good enough to turn on the steam-heated digester for trial, in his kitchen. We all sniffed at the vessel from the time the water was turned on until the water boiled, and all agreed that no odor of any kind was to be detected. I must therefore conclude that the element of disagreeable odor, found by others four weeks since, had disappeared at the time of my examination.

In your waters the microscope revealed abundance of the disintegrated fragments of the more commonly occurring forms of diatoms, but by no means so many in either number or variety as are found in the water of the Croton, at Central Park, in New York. There were also casts of epitheleal cells, fish casts, a few fragments of confervoid growth (green scum), etc. Most of these were from the sediments in number 1. In the sediments from number 4, some of the same forms were seen mixed with minute scales of mica, quartz, and other minerals, driven out by the violence of the discharge from the water pipe. In the other samples almost no sediment occurred, but a few filaments of organic matter floating about, and of no significance. On the whole, the comparative absence of the living organisms is remarkable. This is due in part, no doubt, to the water being collected in very cold weather, when these living organisms are less numerous than in summer.

Trout.—Since this lake was formed it is said the trout have multiplied very greatly in its waters, and some black bass of the lakes have also, I understand, been introduced. Fishing in your reservoir is prohibited with a view to encourage the multiplication of trout and other species. The popular opinion is in favor of a trout or bull-frog in the well, as a means of destroying worms or other animals, obnoxious to our notions of purity. This feeling, no doubt, prompts the desire to multiply and protect the fish in your reservoir. But I have been led to ask myself, if this might not be carried too far? Too many large fish in a limited volume of water may certainly impair, rather than preserve its purity. I am by no means prepared to say that the "fish-like flavor," which some have detected in your water, is due to this cause. I have myself failed to detect the flavor in question, where others find it. But the comparative scarcity of animalcula suggests the inquiry whether the fish have not devoured them, and thus impaired the balance of organic nature?

ANALYSIS.—TABLE 1.

Showing Weights of Impurity in Grains and Hardness, in one Standard Gallon of Water Supplied to the City of Norwich.

No.	Source.	Mineral Matter.	Organic and Volatile Matter.	Total Solids Impurities.	Hardness.
1.	22 ft. from surface of Lake	1.166	0.709	1.866	0.560
2.	12 ft. from surface of Lake	1.149	0.600	1.749	0.540
3.	Surface of Lake	1.050	0.583	1.633	0.510
4.	Waste Pipe	1.399	0.700	2.099	0.580
5.	Faucet at Richmonds	1.071	0.795	1.866	0.560
	Average	1.167	0.676	1.844	0.546

It is, however, by comparison with other well-known waters that we obtain a relative judgment of the purity of this water of Norwich.

TABLE II.—PURITY OF CITY WATERS.

Impurities Contained in One U. S. Standard Gallon of 231 Cubic Inches, Expressed in Grains.

City.	Source and authority.	Mineral or Inorganic matter.	Volatile and organic matter.	Total Solids.	Hardness.
Norwich,	Lake average, 1873 (Silliman.)	1.167	0.676	1.844	0.546
Boston, Mass.	Cochituate, 1845 (Hayes.)	2.44	1.23	3.67	
" "	" 1871 "	2.37	0.83	3.20	0.49
Charlestown, Mass.	Mystic Lake, 1861 (Silliman.)	7.50	2.08	9.58	3.46*
" "	" 1871 (Hayes.)	3.96	1.72	5.68	0.85
Fall River "	Wattuppa Pond, 1870 (Appleton.)	0.96	0.84	1.80	0.20
Providence, R. I.	Pawtuxet River, 1867 "	1.24	1.33	2.57	0.57
Hartford, Conn.	Conn. River, 1861 (Silliman.)	1.82	1.25	3.07	1.64
" "	Trout Brook, 1851 "	1.95	1.95	3.91	1.19
Springfield, Mass.	Chicopee River, 1871 (Hayes)	1.72	1.24	2.96	0.30
New York.	Croton River 13 wks. '67 (Chandler.)	3.90	0.66	4.56	2.51
"	Croton River, 1868 (Chandler.)	3.31	1.14	4.45	
"	" " 6 mos. '69, "	4.11	0.67	4.78	
Albany, N. Y.	Hydrant, (Horsford.)	8.47	2.31	10.78	
"	Hudson River, 1872 (Chandler.	5.424	0.699	6.123	3.50
Rochester, N. Y	Genesee River, 1871 "	12.020	1.23	13.25	
Chicago, Ill.	Lake Michigan, (Blaney.)	5.62	1.06	6.68	

These examples might be greatly multiplied, but the above will probably suffice to show your citizens that the Norwich water is exceptionally pure, in both organic and inorganic impurities, as well as in hardness. This would be still more evident if we were to quote English examples. The River Thames, at London, for example, has over 16 grains to the gallon of solids, and its hardness is 14 degrees. Many people even yet believe wells to be more pure than lakes or reservoirs, or rivers. This is particularly erroneous, as may be seen by inspecting the following table of well waters:

(*See Table III, on next page.*)

I find no recorded analyses of the well-water of Norwich, but presume it must be about like that of Providence and Fall River, above quoted.

CONCLUSION.

The results of this investigation appear to me to sustain the conclusions,

That the Norwich water, as compared to other city waters, is of exceptional purity.

That remarkable care and good judgment have been exercised in preparing the lake, or reservoir, to secure cleanliness and freedom from objectionable circumstances.

When the water is shut up in the mains, under a pressure of five or six atmospheres, the air dissolved in the water is greatly condensed, and when the pressure is relieved at the tap the water rushing out with force foams and sparkles with escaping air, carrying with it the peculiar odor of the vegetable matter. Hence it appears by such evidence as I have been able to obtain, the annoyance is temporary.

The water, at first offensive, allowed to stand a few hours has lost all odor. I venture to predict that the evil will disappear, as it came, without any assignable reason, and that your water will steadily gain favor with all classes of citizens.

I have the honor to remain, gentlemen,

Your obedient servant,

B. Silliman.

New Haven, January 20th, 1873.

* Mystic Lake is an arm of the Sea, cut off from tide by a bar, with its bottom much below sea level. Only its surface water is used; its solid contents, chiefly marine, increase with depth; at 21 feet 18.53, and at 50 feet from surface 63.69 grs. were found by me in 1862.

TABLE III.

Composition of Various City Wells, in Grains per Gallon.

City.	Source and authority.	Mineral matter.	Organic matter.	Total Solids.	Hardness.
Springfield, Mass.	Average of 5 wells, 1871	10.49	2.24	12.73	3.13
Boston, "	Well on Beacon st., 1843. (Hayes.)	50.05	1.21	51.27	
Hartford, Conn.	Old State House, 1847. (Silliman.)			46.55	10.55
Providence, R. I.	Average 24 wells, 1868. (Silliman.)	24.07	8.77	32.84	10.92
Fall River, Mass.	Average 17 wells, 1870. (Appleton.)	25.16	7.00	32.16	12.17
New York.	West of Central Park. (Appleton.)	38.95	4.59	43.54	
"	Well in 22d St., 1864. (Chandler.)	24.29	23.88	48.17	
London, England.	Leadenhall St., (Letheby.) (Draper.)	90.38	9.59	99.97	50 00

Trial of the New Electric Light Machinery at the House of Commons.

Gramme's magneto-electric machine has been now for several months before the public, and the effects obtained, says *Engineering*, have been of such a nature as to confirm our statement that, scientifically and practically, it is one of the great inventions of the age.

The essential requisite for the production of electric light is, that the machine evolves a current of considerable quantity and tension, for experiment proves that the most effective arrangement for illuminating purposes is neither quantity nor tension alone, but a combination of both, which may be easily obtained by paying due attention to the gage and length of the wire, the connection of the bobbins, and the speed with which they are driven. In the present case, the velocity need not exceed a maximum of 350 revolutions per minute.

Such a moderate rate obviates the great inconveniences caused in other machines by the overheating of the armatures. This is the great drawback in Ladd's and Wilde's apparatus, which in other respects are admirable pieces of workmanship and skill. Practically this advantage appears to us to be of as much importance as the distinguishing feature of the Gramme itself, namely, the absolute continuity of the current, and its uniformity of direction. This developement of heat causes not only mechanical inconveniences, but also, by raising the temperature of the conductors, it increases the resistance and thus diminishes the strength of the current. Now the heat developed in the Gramme machine becomes perceptible only when the work to be done is not proportional to the current generated. But as the electro-motive force varies with the rapidity of rotation, it is evident that the latter may be regulated to suit the requirements of the case. By attending to this, little or no heat may appear in the coils, and a very large fraction of the power expended may be converted into useful work. On the night of May 25, we had the opportunity of examining the apparatus on the clock tower; the speed was only 300 revolutions per minute. The machine is in the engine room under the Peers' lobby; the interpolar wires are bracketed to the walls from which they are insulated by passing through the space between V shaped pieces of edonite. The wires are not covered, insulation from the air being deemed unnecessary. They are carried from the engine room to the lantern of the tower, a distance of of 900 feet; consequently three times that of the Foreland, and the greatest distance, we believe, the terminals of an electric light generator have as yet been carried. The gage used is the 000 B. W. G., or .425 of an inch in diameter. The intensity of the light on the 25th of May was equal to 8,000 candles. Very dark glasses were required to look at the lantern even from a considerable distance. The beam, as it shot through the air, reminded one of the lustrous silvery appearance of the comet of 1858 when in perihelion. At the place illumined by the beam, objects could be seen, and books and letters read with as much ease as in solar light, allowance being made for the mellowness of the one and the brilliant argent color of the other. At Trafalgar square, a very black shadow of the pillar was cast over the National Gallery; at the Duke of York's column, a very pleasing effect was produced by the sharp and well defined shadows cast by the trees and their foliage. At these two places, we endeavored to realize the difference between the electric light and that emitted also from the clock tower by the 300 gas burners of Mr. Wigham, enhanced by the most elaborate optical aids; and we must say that the contrast was indeed very striking, a few minutes having elapsed before we were able to discover the path of the beam projected by the latter. In the immediate vicinity of the Houses, Mr. Wigham's light is very soft and pleasing to the eye; but at a distance, by no means considerable, it is scarcely visible. Perhaps the proximity of the electric light may contribute to diminish its splendor; if so, the results are all the more in favor of the new machine.

The carbon points are eight inches long and half an inch in thickness. They last for about four or five hours, and then require to be replaced.—*American Artisan.*

Two Dollars per Barrel for Oil.

Referring to the wonderfully low prices for petroleum that rule in the oil country, a contemporary says:

"This price is one of the mysteries of the age. Every nation and clime, save the cadaverous refiners and the "Shent per Shent" exporters, are willing to pay an equivalent for the product of this risky enterprise (oil producing). The impecunious condition of the producer is heralded to Antwerp, Bremen, Liverpool, New York, and Philadelphia. Refiners' Associations lend a willing hand to crush out what little is left, by sending a wail to the region "too much oil," and selling short at a price which they know the crude cannot be produced at, and the poor producer is eager to eat the crumbs from the master's table. Unfortunately, the producers, from the want of organization, are unable to enlighten themselves as to the true situation of the outside markets, and take for granted that all is gospel which the Association buyer tells them. We firmly believe, from a very close study of the situation that we are not to-day producing as much oil as the world demands. Our markets at home and abroad have nearly doubted their demands, while our production is not over fifty per cent. greater than last year. A few figures, guaranteed to be reliable, will not be amiss:

	Barrels.
The increase of exports from New York over last year is	22,500,000
Same from Boston	206,107
Same from Philadelphia	6,500,000
Same from Baltimore	530,000
Increase of exports over same time, 1872.	29,736,107
The total export from the country from January 1st to June 10th, 1871, was	53,000,000
Same time, 1872	50,000,000
Same time, 1873	79,500,000

"Many would suppose, from this great increase of exports, that the markets abroad were full to overflowing. The contrary is the fact. New consuming markets opened for the commodity take very much of this increase, as will be seen by the following statistics, compiled from shipping lists:

	Barrels.
To the Dutch East Indies (entirely new market, there has already been shipped this year	500,000
To Venice (new market)	150,000
To China and East Indies (increase)	2,000,000
To Central America (increase)	30,000
To Africa (increase)	100,000
To Australia (increase)	500,000
To British West Indies (increase)	100,000
To Cadiz and Malaga (increase)	500,000
To Taragona (increase)	500,000
To Cette (new market)	100,000

"This same ratio of increase shows itself in almost every available commercial point of the globe. The orders now at the seaboard are far beyond the tonnage capacity of the oil marine. Philadelphia alone needs tonnage for near two hundred thousand barrels more than is at present available. With these facts before us, why are we so eager to give this commodity at *less than cost* to the world? Is it not taxing American industry for the benefit for the benefit of foreign countries, unsolicited?"

The Coming Pavement.

Recently there has been laid down on Fifth avenue, at its intersection with Broadway in this city (24th street), a trial specimen of the new Grahamite asphalt pavement. The example in question covers the street for half a block, and is placed just where it will receive the severest tests, from the wheels of omnibuses, ice carts, and throngs of vehicles of all sorts. If the new pavement can stand the racket here, no other test will be required. So enormous is the travel in this part of the city that the cross-walks, made of thick granite slabs, are soon grooved with ruts, cut by the wheels of heavy vehicles.

The new asphalt pavement is composed of a material termed Grahamite, found in West Virginia, and is alleged to possess more cohesion, tenacity, and elasticity than the famed *Val de Travers* asphalt so extensively used for paving purposes in Paris and other European cities.

Grahamite does not fuse until it reaches 800° Fah., while the ordinary asphalts generally fuse below the heat of boiling water. The higher fusing point is due to the large quantity of asphaltene which the Grahamite contains. The Grahamite pavement possesses a high degree of elasticity, which affords great relief to the feet of horses and prevents the wear of vehicles; it is also so tenacious and hard that it will stand the heaviest blows from a sledge, only suffering compression at the surface. We have seen this test repeatedly applied, and have further noticed that the heaviest vehicles roll over it without making the slightest impression. It presents an even surface and forms, in every outward respect, a most admirable pavement. If the example now under trial shall prove, on the lapse of time, to be as really good as it now is, we have no doubt that our citizens will be glad to give it a general introduction. Wood pavements are a failure, and granite blocks are dreadful to travel upon. It may be that Grahamite is the coming pavement.

The pavement question deeply concerns every city and town in the land; and if anybody wants a subject to study upon, with a view to devising improvements, here is a grand one.—*Sci. Am.*

[The passage about "asphaltene" in the above is somewhat sickening. As all chemists know familiarly, there is none of the spurious substance called by Boussingault "asphaltene" in grahamite, and moreover that there is no such substance (chemically speaking) as asphaltene in Nature.

The present writer does not know whence our respected contemporary got his information about the composition of the peculiar mineral species which the writer himself called by the specific name *grahamite*, in view of its specific nature, which has been fully set forth in the columns of this Journal, and has passed into the text-books of science (*vide* Dana's Mineralogy), "asphaltene," and "petrolene" were unfortunate *inventions* of an illustrious chemist, and were abandoned even by their inventor. They have long since gone into limbo. Will not our *confrere* let them there rest in peace? Grahamite has about as much, or as little, relation to "asphalt," as cheese has to chalk.]

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—Ed.

A Circular Subject.

[The courteous tone of the communication below, requires that it be met with the reciprocal courtesy of insertion; though altogether outside of the scope of our usual subjects. Hence the Editor will not discuss the question as to whether circular degrees are linear measurements or not? but leave this paradox to the many readers it will doubtless have, of sufficient aritlmetrical attainments to grapple with our ingenious correspondent. Doubtless some readers have more time than the Editor, for this sort of work. At least it is to be hoped so.]

New Orleans, August 21, 1873.

Mr. Editor: I desire to submit for the consideration of yourself and readers, a brief demonstration touching the relation of the diameter to the circumference of the circle; a demonstration which has long vexed the mathematical world, and often pronounced an impossibility except approximatively. This you will notice in any of our text books on Geometry; for instance, see Davis's Legendre, B 5, P 16, Scholium 2.

Of course it would illy become me to gainsay all of the able mathematicians who have existed since the days of Archimedes, who have to *their* satisfaction shown that the relation is nearly as 7 to 22, or as it is usually expressed in decimals—3,1415926, etc. I therefore simply offer the following demonstration, hoping that some skillful mathematician will point out wherein I am in error.

I lay down the statement that the relation of the diameter to the circumference of the circle is as 6 to 19 and not as 7 to 22. To prove which I take the general notation of circular measurements as my base of operations, viz:

Every circle is divided into 360 equal parts called degrees—hence if I am correct, when the circumference is given to find the diameter, I shall have the following rule, viz:

Multiply the circumference by 6 *and divide the product by* 19.

EXAMPLE.

The circumference of a circle is 360°, what is its diameter?

As this is a general notation of measurements, it matters not whether we regard these degrees each as one inch, one foot, or one mile.

$$\begin{array}{r} 360^\circ \\ 6 \\ \hline 19)2160(113\tfrac{13}{19} \\ 19 \\ \hline 26 \\ 19 \\ \hline 79 \\ 57 \\ \hline 13 \end{array}$$

The diameter then is 113 13–19 degrees, or if we regard each degree as one mile the diameter would be 113 13–19 miles.

Now, regarding this as the diameter of our circle one half of it would be the radius, viz: 56° 16–19 or if we regard each degree as one mile our radius would be 56 16–19 miles; hence the distance around the inscribed hexagon would be six times that amount either in degrees, miles, or any other system of measurements we may use—

$$\begin{array}{r} 56\ 16\text{–}19 \\ 6 \\ \hline 336 \\ 5\ 1\text{–}19 \\ \hline 341\ 1\text{–}19 \end{array} \qquad \begin{array}{r} 16 \\ 6 \\ \hline 11)96(5\ 1\text{–}19 \\ 95 \\ \hline 1 \end{array}$$

It is therefore determined that the periphery of an inscribed hexagon is 341° 1–19, or if we regard each degree as one mile, it would be 341 1–19 miles.

Now, if we subtract the periphery of the hexagon from the circumference, we will have the difference in whatever measure used

$$\begin{array}{r} 360^\circ \\ 341^\circ\ 1\text{–}19 \\ \hline 18^\circ\ 18\text{–}19 \end{array}$$

Thus we have the difference in degrees, 18° 18–19.

It is evident if we regard each degree as one mile, that the difference would be 18 18–19 miles.

Now we must bear in mind that the diameter of our circle is 113 13–19, or if we please 113 13–19 miles.

If then we divide this diameter by 6 we will observe that our quotient will be 18° 18–19, or 18 18–18 miles, which is precisely the same as the difference between the periphery of the hexagon and the circumference of the circle, viz:

$$113^\circ\ 13\text{–}19 \div 6 = 18^\circ\ 18\text{–}19$$

Of course if we add the difference between the hexagon and the circumference, to the hexagon we will have the circumference, viz:

$$\begin{array}{r} 341^\circ\ 1\text{–}19 \\ 18^\circ\ 18\text{–}19 \\ \hline 360^\circ \end{array}$$

Since, however, one-sixth of the diameter is precisely equal to the difference between the periphery of the hexagon and the circumference, we necessarily have the rule when the diameter is given to find the circumference.

Multiply one half of the diameter by six, to which add one-sixth of the diameter.

$$R \times 6 = \text{Hex. and Hex.} + \frac{D}{6} = C$$

Or we may have it thus:

Multiply the diameter by three and one-sixth.

It thus appears that the diameter of every circle is 6–19 of the circumference, and the periphery of every inscribed hexagon is exactly 18–19 of the circumference. This may be practically demonstrated by any mechanic or artizan.

This is one of many theorems that follow, wherein I must say that I can discover no error. Some one will say, perhaps, that the weight of authority is against me. So was the weight of authority against Galileo, but that proves nothing.

Let some one, either mathematically or practically, show my conclusions to be erroneous. If correct, all of our astronomical calculations are erroneous. The French metric system is incorrect—even a barrel, or steam boiler, has more capacity than is attributed by our present calculations.

Respectfully,

J. E. Wallace.

P.S.—I submit the enclosed demonstration with reluctance, because of the dogmatism of many of our unthinking would-Be scientists. I am, however, fully certain, both mathematically and mechanically, of the truth of my position.

The inductions by which this result has been attained, are by far too abstruce for ordinary readers. I have, therefore, so simplified the operation, as to place the truth within the comprehension of the most ordinary mathematical minds.

The deductions flowing from the main theorem are necessarily somewhat startling to those firmly anchored on old geometrical doctrines. I shall, therefore, expect but few such to look with favor upon a very simple demonstration like this.

At some future time I may call your attention to some chemical facts and inductions of paramount importance. I at present, however, simply desire to place this matter before the world, and say, that upon this fundamental truth hangs the key to a universal metric system, which our government should take the initiative in adopting.

Our present calculations in the measurement of spheres, cylinders, cones, etc., all require revision.

J. E. Wallace.

Naphthaline.

Newport, R. I., September 6, 1873.

Mr. Editor: The solution of the naphthaline difficulty seems to make but slow progress, whether owing to the erratic character of the trouble, or to the fact that the solution has not been earnestly and persistently undertaken. Its eccentricities in suddenly appearing in out of the way places, dedicated as byways and highways of the gas, the persistent and obstinate nature of its obstruction, its furtive and vagabond character, that seems to elude acquaintance and shun recognition, constitute it the perpetual menace of an unseen enemy, and demonstrate the necessity of learning more intimately the conditions which govern its production and deposit.

Its production seems to be in a great measure the peculiarity of clay retorts, and hence is the result of some action of clays that does not obtain in iron retorts. When a charge of coal is placed in a highly-heated clay retort the first evolution of the gas is very rapid, resulting from the acquired heat of the retort. But this very rapid evolution of the gas reduces the interior heat of the retort very rapidly, and before the heat from the furnace can react through the thick non-conducting sides of the clays, the conditions of the interior are very favorable for the production of the heavy carburets of hydrogen including naphthaline. The impetus given to the evolution of the gases from the coal by the fierce heat of the freshly charged retort is not lost, until some time after the interior is so deadened, that the remaining heat is insufficient to thoroughly decompose the gases produced, so as to make the commercial article we want to deliver to our consumers.

But as the heat fails the evolution grows less, and the heat from the exterior begins to assert itself. Very soon an equilibrium is restored; that is, the furnace heat is transmitted through the sides of the retort, and the evolution of gas increases; its rapidity of production depending, not as at first upon the degree of heat which the retort had acquired, but on the amount of heat which can be made to penetrate the sides of the clay. The contest between the production and conduction of heat to the interior of the retort, and its absorption by evaporation of the gases from the coal is now equal, and the conditions thenceforth are favorable to the manufacture of permanent and reliable gas.

No such condition is possible with an iron retort. The moment it feels the cooling of a fresh charge of coal, its thin and conducting material restores the lost heat promptly from the furnace. The equilibrium of application and absorption of heat is never lost in an iron retort, or at best only for a brief moment; and consequently the chances for the production of of such a fat hydrocarbon as naphthaline are very slim.

The remedy for such a condition is to shorten the period during which the heat of the furnace is overcoming the sudden cooling of the interior of the retort. This would seem to suggest the advisability of removing all shield and guard tile from around the retorts, except such as experience shows to be necessary to their safety and durability. But this only tends to *lessen* not to prevent the production of naphthaline, and hence it must be looked to and looked further along among the processes of cooling and cleansing.

The conditians of its deposit are not very well determined. In its progress through the works, traces of it may be seen at almost any point, but more particularly after the gas has become pretty well cleaned. A copious shower of cold water, just as the gas enters or emerges from the condensers, seems to be very healthy for naphthaline, and frequently develops it strong and abundant. On the contrary, its introduction to a small quantity of water impregnated with ammonia, immediately after leaving the condenser, seems to check its tendency to deposit. An ordinary scrubber into which the gas enters at the bottom and meets the water in small quantity, trickling down over broken surfaces, answers very well. The ammonia furnishing the alkali, and the super-carburet the fat, a substance is produced which has a saponaceous appearance, and dissolves readily in water.

If members of the fraternity who are troubled with naphthaline will study closely *all* the conditions of its

production and deposit, as far as possible, and communicate them to the JOURNAL, we could compare notes, and be on the high road to positive knowledge on the subject. W. A. S.

Carbon in Retorts.

SENECA FALLS, N. Y., August 23, 1873.

Mr. Editor: Finding a large quantity of black dust, or carbon, inside of small retort "using crude petroleum," in a portable works, I thought I would write for information about getting rid of it. It hinders the heating of the retort, and I do not get as much gas when a good deal of that carbon is in the retort, as when the retort is clean on first starting. I think the carbon should be all turned into gas. And I propose to build a small portable works, using crude petroleum, and forcing into the retort with the petroleum a certain portion of *air*, believing I will get rid of all solid carbon, and much more gas from a given quantity of petroleum. I also propose to use coal tar in the same manner, believing it can be done with the injection into the retort of *air*.

Has the injection of air into the retort with the material to make gas, ever been tried, or am I the original proposer? Will you please give me your opinion of the thing proposed. Also, would any danger arise from explosion of the introduction of air?

What proportion of air could I safely inject?

Would gas companies be gainers if they could convert tar into gas; and would not the gas be of better quality, if tar was all converted into gas? And will not the injection of air with the tar overcome all the difficulties heretofore experienced in making gas from coal tar? Yours respectfully,

W. W. BINNEY.

Enrichment of Coal Gas.

"TITUSVILLE HERALD,"

TITUSVILLE, PA., August 20, 1873.

Professor HENRY WURTZ.

Dear Sir: We noticed favorably your article on enriching coal gas (see copy of *Herald* which we have sent you). The subject is one of some importance to the people of this region, and you will confer a great favor if you have the data at hand, by sending us a list of the gas companies of the United States; also those which belong to the Association, the amount of coal they annually consume, and the probable percentage of petroleum which could be used to advantage. We have an immense surplus of petroleum here at present, and no better time could be fixed upon for a united concert of action on the part of the gas companies, for adopting your suggestions, and purchasing the crude material at a low figure. There is unmistakable evidence that the article is practically inexhaustible, and there need be no apprehension of a scarcity in the future.

Yours very respectfully,

JOHN PONTON,

Assistant Editor *Herald*.

[The points of information above desired are in process of collection, but far from being yet in a condition for publication, and the undersigned cannot therefore oblige Mr. Ponton, as he regrets to say.—HENRY WURTZ.]

Burning Tar as Fuel.

Mr. Editor: Feeling a deep interest in whatever affects the prosperity of gas works, I send you the following which may be of interest to some of the fraternity:

For fifteen months past we have been successfully burning the tar made at our works, under our retorts, and find a handsome profit by so doing.

We find that every gallon of tar, is worth as fuel, under the retorts, about two thirds of a bushel of coke, and, in addition to that, the make of gas is two to three tenths of a f ot more, per pound of coal, while burning tar than when using coke. This last we believe to be owing to the high and steady heat produced by the uniform tar fire.

Every gas works large and small, and especially the small works, have an interest in utilizing the tar made to the best advantage. Some companies may have a sale for tar at a price as good—or better—than burning it under their retorts, with the benefits above mentioned. Others have little or no use for it and find it a nuisance, while every company has sale for all the coke they can make. It cost us about $50 to fit up with the proper appliances for burning tar, with the results above mentioned; and, for the same expense, every gas company, large or small, may do the same. Respectfully yours,

CHAS. NETTLETON, Pres. East Chester Gas Co.,
117 Broadway, N. Y. city.

Products of the Destructive Distillation of Lignite.

BY B. NIEDERSTADT.

The lignites examined came from the Rhenish-Hessian basis. 1. Lignite from Meissner, of a red-brown color and woody texture; spec. gravity 1·12. 2. Lignite from Rheinhardswalde, grey or black, containing abundance of resin: spec. gravity, 1·13. 3. Brilliant lignite of Meissner, black, fracture fibrous, lustre vitrous; spec. gravity, 1·32. 4. Lignite of Hirschberg, brownish-black, in tree-like masses: spec. gravity, 1·35. The following is their elementary composition:

	1.	2.	3.	4.
Carbon	51·238	58·782	69·995	60·302
Hydrogen	4·169	4·042	3·192	4·859
Oxygen	32·326	20·803	17·591	20·169
Nitrogen	0·175	0·150	0·123	0·121
Ash	0·795	5·940	5·470	3·167
Moisture	10·297	10·283	3·629	11.391

On distillation these lignites yield solid, liquid, and gaseous products; at a dark-red heat, a brown tarry matter passes over along with combustible gases. To separate the watery portion from the tar, common salt is added to the mixture, heated to 40°. The quantity of tar, when fed from water, amounts to 4 to 5 per cent., and the watery products 43 to 55 per cent., containing acetic acid and ammonia. The oily matters distil over at 95° to 220°, leaving a black pitchy residue. The distillate, on agitation with concentrated soda-lye, yields phenol. On fractional distillation, the portions passing over up to 150°, contain pyrrol and picoline, which boils at 105°, and is distinguished from aniline by not giving a violet coloration with chloride of lime. The part passing over about 220° solidified on cooling, yielding a crystalline mass soluble in alcohol and ether. It melts at 49° to 51°, and is a paraffine formed of hydrocarbons $C_n H_{2n}$. It amounts to 1 per cent. of the lignite employed. The gaseous mixture, from the Meissner liguite, consists of: Hydrogen, 14·26; carbonic oxide, 40·12; marsh gas, 10·29; nitrogen, 4·09; carbonic acid, 2·10; ethylene and superior hydrocarbons, 2·13. There appears, consequently, little prospect of using the gases from lignite for lighting purposes.—*Engineer and Mining Journal.*

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TUESDAY, SEPTEMBER 16, 1873.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

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STOKING BY MACHINERY.

ALONZO F. HAVEN'S INVENTION.

In our issue of July 16, 1873, we began to insert some elaborate accounts of plans which either are now in use, or have been proposed, for applying the power of steam, instead of human muscle, to the arduous task of charging gas retorts—a species of work which has to be done with the regularity of clock work, to ensure success, involving also great exposure to high temperatures; and which therefore appears to call for the aid of the inventor as sternly as the somewhat kindred art of the iron puddler. Remarks have also been made by us on the difficulties of realization of this problem in *economical* practice.

The invention presented in this number by Alonzo F. Havens, late Engineer of the Brooklyn Gas-Light Company, marks our next step, in exposition of this subject; and a most important step it is.

Mr. Havens's experience in the retort house itself, has qualified him to attack the problem with both knowledge and power. His aim has been to combine efficiency with *simplicity*.

His apparatus on a working scale has now been in operation in Brooklyn for several months past. It never fails in its operation, never exhausts its energy, and although capable of doing the work of forty men, has never yet, as we learn from the inventor, asked for higher wages or less time, nor has the heat of the past summer troubled it in the least. It deposits in a retort all the coal the latter can hold, and seems to do this in a manner not to be approached by hand. As now constructed it has put 400 lbs. of coal into a retort, spreading it evenly over the bottom all the way to the extreme rear. It then returns to its bed, ready for a fresh charge, in ten seconds. Its inventor's study, he says, has been to make a machine for existing gas-works, avoiding any necessity of alteration of existing benches or other plant. He claims also, very justly, that there should be a machine which is adaptable even to small works; as regards cheapness, and lack of necessity of employment of a special machinist. Other points he makes are that such a machine should be light enough to avoid danger of breaking through the floor of a retort house which has a cellar, and that it should not take up or require more room than the men, with their hand scoops, that will be supplemented by it.

His machine, he suggests to us, will exact none of the privileges to which human machines are addicted. Decent treatment will suffice for it; and it will be always ready, night and day, for any emergency. The body and soul of a superintendent will have less wear and tear. Mr. Havens's recent *striking* experience will account, to our readers, for these hearty suggestions of his, and doubtless give us also an insight into his motives in turning his attention to this subject.

It is a well-recognized principle that to accomplish hand-work, particularly of this class, by machinery, complexity must be avoided as much as possible. For every day routine work, which *must not* be subject to interruption, something reliable must be had. Complex machines are notoriously unreliable. Combinations of mechanical devices; screws, pinions, cams, cogs, worms, chains, etc., etc., if multiplied, will become even less reliable than the human nerve and muscle. We think we do not err in believing that Mr. Havens has worked in the right direction here, and that his work is good.

There is much more to be said about Mr. Havens's fine invention, which must be seen in operation, as we have seen it, to be fully appreciated; but space fails now.

The machine we understand is on exhibition at the present Fair of the American Institute, by the American Gas Works Construction and Supply Company, of No. 61 Broadway, New York, of which Mr. Havens is Engineer.

AMERICAN "RIVER-POLLUTION"

We have heard that a wise man of old (not very old, except that Time, and every thing else, moves now by steam and electricity) said once that he "didn't want any [of *that* in his'n," probably. Now this remark, though probably less elegant than that of the older and more famous wise man who said "know thyself," may prove not less difficult to carry out in practice.

Let us ponder. The sink of all the pollution of mankind (and other kind,) is the great Ocean, that flows round all the Continents. These impurities no doubt constitute the natural nourishment of monsters engendered in its bosom. We beg their pardon for the epithet, as we do not know that they are any more monstrous than mankind, certainly in a moral point of view. "Devil-Fish", however, supposed by some to have been invented by Victor Hugo, are well known to all naturalists. It remains to be seen whether the human brain is to be allowed to find out all the wonders of the great deep. It is certain that we shall never know all, for that would be Omniscience.

At any rate *that* is the place provided by Nature as a receptacle for the effete discharging from the land. The question has lately arisen in this country, as some years since among older nations, whether rivers shall carry these impuri- from one one town, to be pumped up again and distributed, even in highly diluted form, to the people of another town. We think not. Our own brains, weak though we confess them, cannot retain the idea of such a manifest violation of nature's laws. The suggestion is therefore thrown out and urged, that other men's brains should ponder over this subject here in this country, as of late in Europe. The subject is ponderous. (No pun is meant.)

Our own thinking over it, both in the darkness of the night, and in the brightness of the light, has been that it is better that everything about us should be remodeled, cost what it may; than that we should run such risks. Cleanliness is admitted to be next unto Godliness. Let us, if it may be done, secure cleanliness and purity, first in body, and possibly then in soul.

Pollution of public wells is another subject we have something to say about, and to prove about.

PETROLEUM-GAS.

This subject has occupied our thoughts somewhat, of late, as our readers will have observed. The *National Oil Journal*, of Pittsburgh; which now comes to us regularly, appears to appreciate and to support ably the idea that gas made from *crude* petroleum is to be the enricher of the future. There is enough petroleum, and possibly to spare, for all *this*, though it is absurd to suggest or to dream that it is going to supplant, or even to become a rival, except throughout limited districts, to coal, as a gas-producing agent.

The point we are going now, however, to put before the gas fraternity, is one worthy of their attentive consideration. The excessive cheap-

ness of crude leads to a corresponding cheapness of refined petroleum. This fact is already having its influence lo cally, we hear, on the *profit* (see another note on this page) of some companies. The cheapness is an inducement to some gas consumers to adopt petroleum-lamps, and this is a movement that seems likely to increase. It looks as if gas-producers ought to combine with oil-producers, to prevent petroleum from becoming a "drug in the market." This they can plainly do, as we think we plainly see, by buying the crude petroleum and selling it again, in another form, to gas-consumers. If either the gas, or the oil-producers, will *find out the best way* to put it into this other form, with a view to the profits, it seems to us that the thing is clearly before us. Such a result would cut several ways. The people, the gas companies, and the oil-producers would benefit. Speculators, and, we regret to say, makers of petroleum lamps, would suffer.

A QUEER PETROLEUM ACCIDENT.

A late article on the subject of "Petroleum Gas as an Enricher," which was thrown out without much consideration, has received some attention in other quarters, having been copied into journals in the "oil regions" and elsewhere. The Titusville *Herald* copies it, but very accidentally omits *one word*, a word italicised by us, for the reason that to the gas profession it was the point of the whole article. This word was *profits*.

Now what we want to add, or rather to repeat here, is that the *profits* (we again italicize) are the main thing to be investigated. An eminent member of the Gas Fraternity lately wrote to us as follows :

"The illuminating element is so strong in petroleum, that it will be utilized sooner or later. I doubt if the best method has yet been discovered. Patience and real scientific research will bring it out finally." These are words of wisdom.

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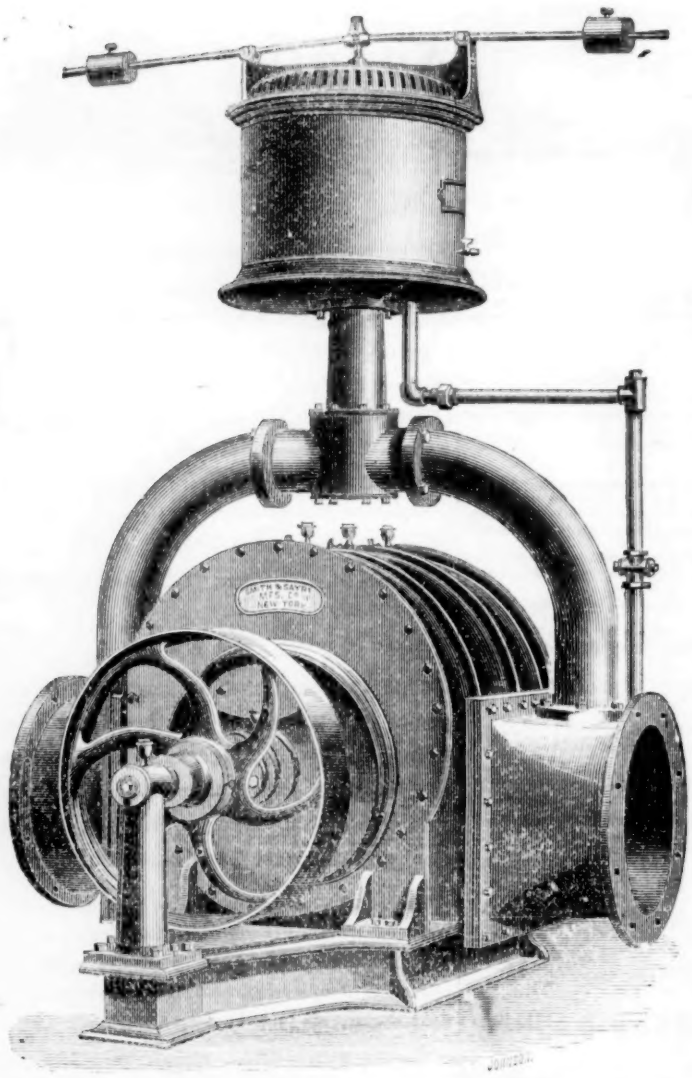

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Yours truly, JOHN ANDREW, Sup't.

DORCHESTER, March 3. 1870.

Mr. E. DUFFEE.

Dear Sir: We have had your Gas Trays in constant use for almost one year and six months and find them superior to any others we have ever used, both in point of economy and efficiency. Truly yours, W. B. BROOKS,
Agent Dorchester Gas-Light Co.

JAMAICA PLAINS, MASS., June 21, 1871.

EDWARD DUFFEE, ESQ.

Dear Sir; The Trays ordered by this company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige Yours truly
JAMES F. ROGERS,
Sup't Jamaica Plains Gas-Light Co.

BROOKLINE, June 11, 1871.

E. DUFFEE, ESQ.

Dear Sir: You will please make a set of Gas Trays for this company as soon as convenient, at price named. In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country. Respectfully yours,
H. A. ALLYN,
Sup't Brookline Gas-Light Co.

BANGOR, August 2, 1870.

EDWARD DUFFEE, ESQ.

Dear Sir: Yours of the 20th ult. is received. In regard to your Gas Trays, I take pleasure in saying that they have been in use over two years, and have given perfect satisfaction and they are in good order at the present time; should have no hesitation in recommending them, believing they are the most durable and easiest kept in order of any with which I am acquainted. Respectfully yours,
W. H. PERRY, Sup't.

OFFICE OF THE SPRINGFIELD GAS-LIGHT CO.
SPRINGFIELD, MASS., Oct. 10, 1871.

Mr. WARD,
President Hartford Gas-Light Co.

Dear Sir: I have been using Gas Screens made by the American Gas Screen Company, for nearly a year, and find them superior in every way to the wooden Screens made and formerly used by the Springfield Gas-Light Co. I can purify more gas with the same quantity of lime, there being more surface to the Screens; and I consider them more durable, and recommend them to your consideration.

Yours with great respect,
GEORGE DWIGHT.

ROXBURY, June 14, 1872.

EDW. DUFFEE, ESQ.

Dear Sir: In answer to your inquiry regarding your Patent Gas Screens, I am happy to be able to say, that after nearly three years constant use we are perfectly satisfied with them being able to purify over fifty pet cent. more gas with them, than with any other Screen we have used.

Yours respectfully,
THOMAS J. FISHOU

OFFICE DETROIT GAS-LIGHT CO.,
DETROIT, MICH., April 22, 1872.

AMERICAN GAS SCREEN MANUFACTURING CO., HAVERHILL.

Gentlemen: The Screens bought of you work far better than any we have ever used. As a proof, we have with the same quantity of lime purified *twenty per cent.* more gas with your Screens than with any others, and the work well done. The workmen are also better pleased with them—they being light and handy to work. They also relieve the pressure very much upon the retorts, and I cheerfully give you my experience. Yours truly,
P. E. DEMILL. Secretary.

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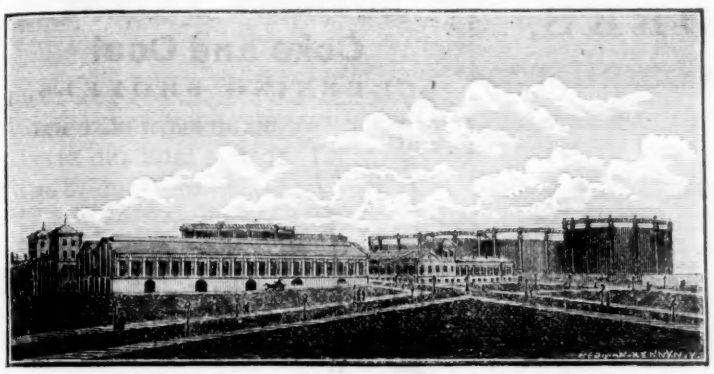
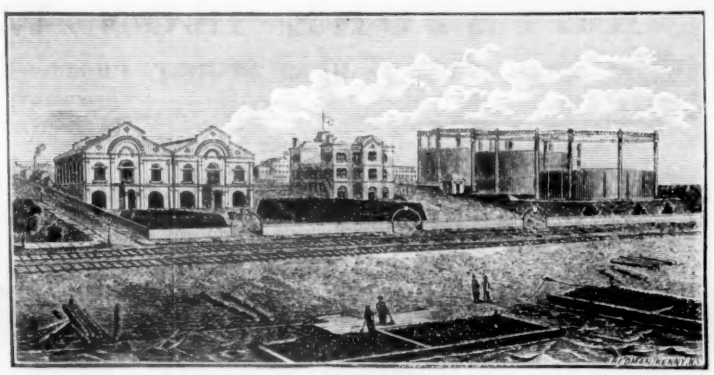


CINCINNATI GAS WORKS, ERECTED 1871-72-73.—WM. FARMER, ENG.



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SEVERAL CONTRIVANCES HAVING BEEN DEVISED for the purpose of dispensing with the dip-pipe seal, by means of a valve, or cut-off, between the retort and the hydraulic main, in gas works, since this method of making gas was introduced by the AMERICAN COAL GAS LIGHT IMPROVEMENT COMPANY, all of which are infringements upon Letters Patent, numbered 95,459—116,450—and 119,135, owned by said Company. All Gas-Light Companies are cautioned against the use, without license or authority from the undersigned, of said devices.

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JOHN H. BLAKE, President.
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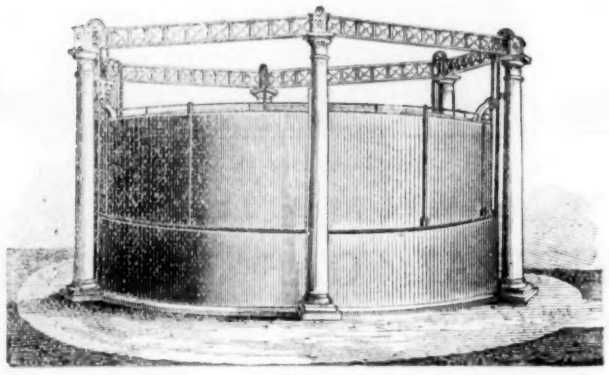

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E. W. McGINNIS, Secretary and Treasurer.
JOHN P. KENNEDY, Chief Engineer.
LEONARD D. GALE, Consulting Chemist.

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We are also prepared to contract for putting said process into successful operation in your works, furnishing all the necessary plans, materials, and workmen for that purpose.

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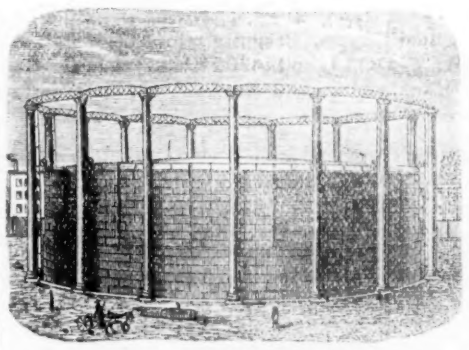

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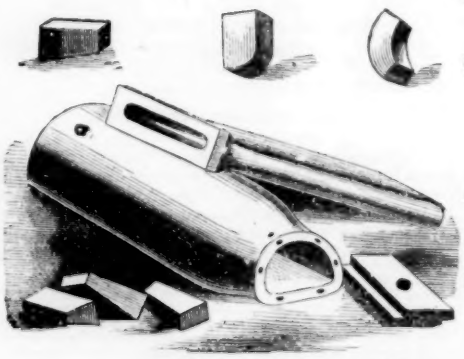

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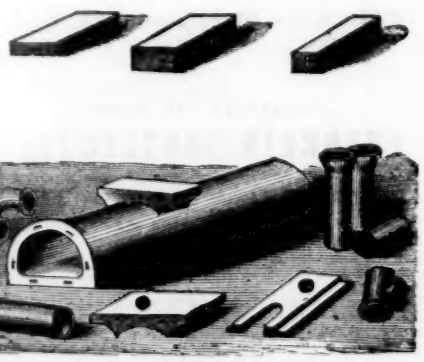

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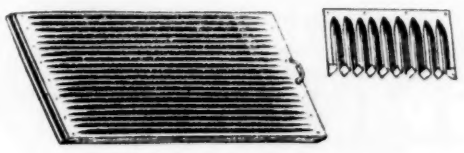

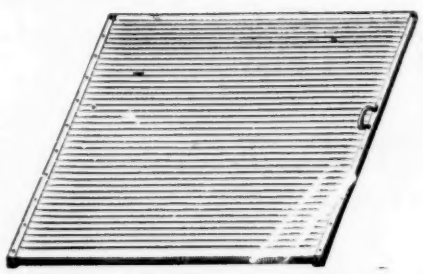

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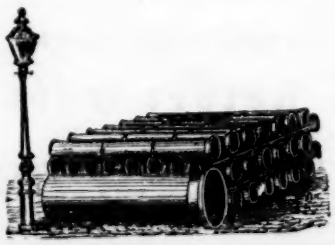

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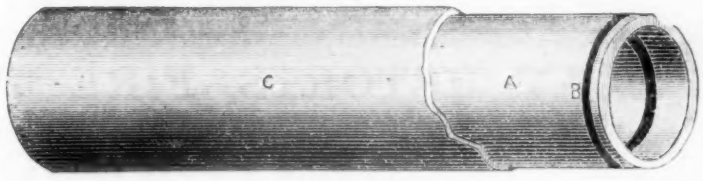

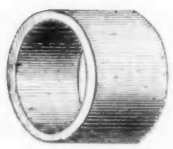

Fig. 2.

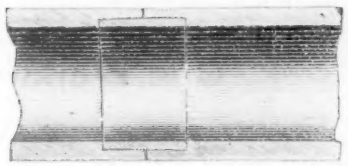

Fig. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

Fig. 2.—Thimble for Connection. Fig. 3—Horizontal Section and Connection.

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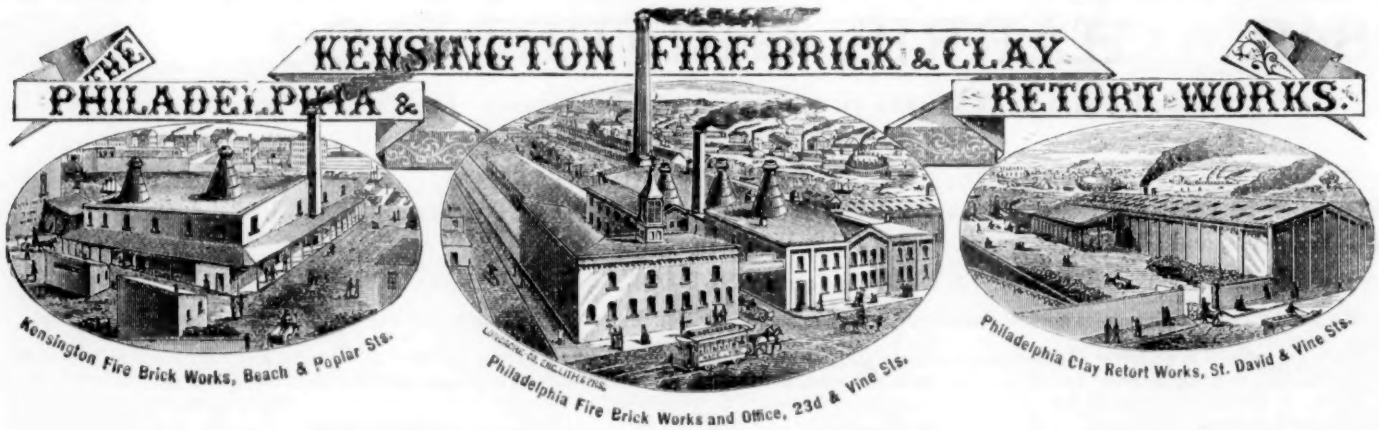
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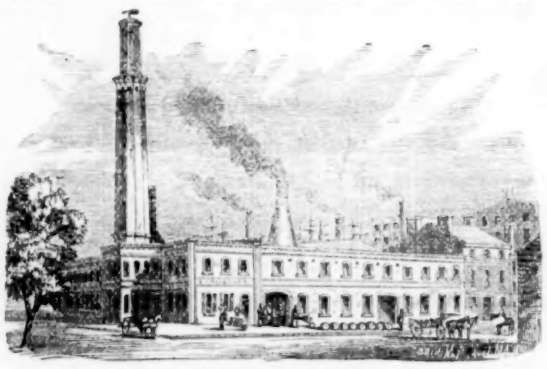

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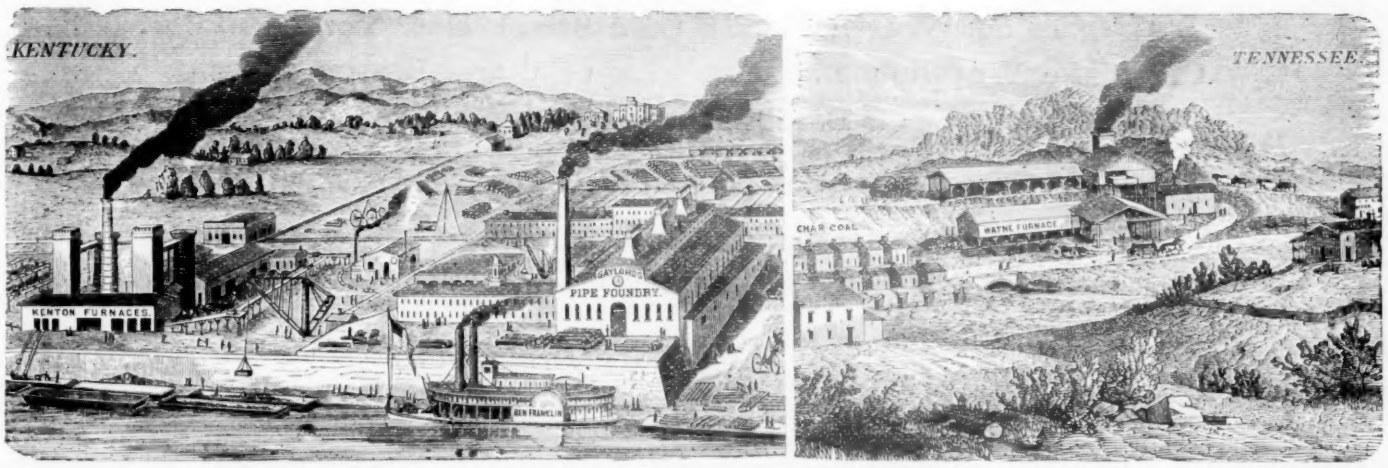

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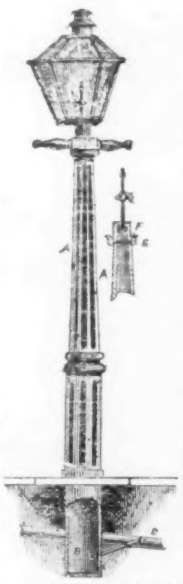

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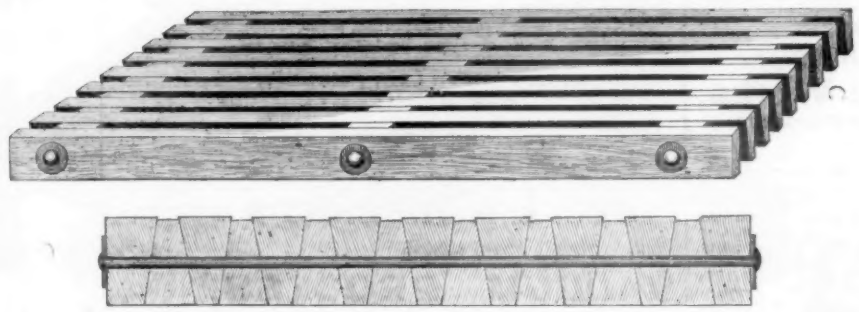

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East Newark Gas-Light Company, N. J.
Binghampton Gas Company, N. J.
Zanesville Gas Company, Ohio.

New Orleans Gas Company, La.
Salem Gas-Light Company, Mass.
New Britain Gas-Light Company, Conn.
Rahway Gas-Light Company, N. J.
Trenton Gas-Light Company, N. J.
Elmira Gas Company, New York.
Erie Gas Company, Pa.
Columbus Gas-Light Company, Ohio,
Westchester Gas-Light Company, N. Y.
Santa Cruz Gas Company, Cal.
Lawrence Gas-Light Company, Kansas.
Salem Gas Company, N. J.
Indiana Gas-Light Company, Pa.
Peoria Gas Company, Ill.
Montclair Gas Company, N. J.
Williamsport Gas Company, Pa.
Wooster Gas-Light Company, Ohio.

Augusta Gas-Light Company, Ga.
Huntsville Gas Company, Ga.
Chattanooga Gas Company Tenn.
Murfreesboro Gas Company, Tenn.
Hagerstown Gas-Light Company, Md.
Hanover Gas Company, Pa.
Easton Gas Company, Pa.
Uniontown Gas-Light Company, Pa.
Coatesville Gas-Light Company, Pa.
Houston, Gas Company, Texas.
Wilkesbarre Gas Company, La.
Middletown Gas Company, New York.
Washington Gas-Light Company, Pa.
Princeton Gas-Light Company, N. J.
Newark Gas Company, Ohio.
Pontiac Gas-Light Company, Mich.
And numerous other Companies.